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SUBJECT: RENEWABLE ENERGY IN NUEVO LEON: A VIABLE MODEL?

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¶1. Summary: Nuevo Leon is blazing new trails as it seeks to counteract rising energy costs. A public-private initiative known as Simeprode that converts the methane gas from a landfill into biofuel is already lighting up the streets of Monterrey and neighboring municipalities and powering the Metro. A wind energy project is also underway that will be used by the state to provide more public lighting. Although Nuevo Leon has been promoting alternative energy projects, the real push for these seems to be coming from the private sector. No state government funding or tax incentives exist. Despite this, the success of Simeprode and the generation of ideas, inventions, and projects being proposed by private entities are creating the image of Nuevo Leon as a leader in renewable energy.

¶2. Electricity in Mexico is managed by the CFE, Mexico's national electricity commission. The GOM has the exclusive right to generate, transport, transform, distribute and supply energy. Although regulations were relaxed in 1992 so that companies can produce their own power, the Mexican constitution prevents direct sales to other consumers. According to the World Bank's Energy Sector Management Assistance Program, Mexico's pricing system poses another regulatory challenge by placing a wedge between the price paid to private investors and that charged the end user. The prices faced by the consumer reflect the average cost of supply, covering a broad mix of generation plants (including many outdated, high-cost fuel-oil and coal-fired thermal plants). Because these costs are passed on to consumers, the price is high compared to that of electricity generation from newer plants. Consumers therefore pay prices at which it could be economically attractive to use renewable energy options. With gas prices skyrocketing, even the CFE has recognized the growing overexposure to the natural gas market for electricity generation, making renewable energy look increasingly more attractive.

#### Turning Trash into Energy

¶3. In 2003, a project using the biogas from a landfill as fuel was launched by Bioenergia de Nuevo Leon, S.A. de C.V. (BENLESA). It is the first such project in Latin America. BENLESA is the result of a strategic alliance between Bioelectrica de Monterrey, a private company, and the government of Nuevo Leon through SIMEPRODE (System for Ecological Waste Management & Processing), a decentralized public entity. The landfill being used is located in the municipality of Salinas Victoria, Nuevo Leon, about 21 miles outside of Monterrey. The BENLESA plant opened in September 2003 with an initial total capacity of 7 MW. According to Jorge Padilla Olvera, Director

of SIMEPRODE, a second plant is being built and is almost finished. This will increase capacity to 12.72 MW. It is estimated that with this expansion the plants will generate 40,000 MWh per year. SIMEPRODE will be able to supply 40% of public lighting in the Monterrey metropolitan area. This is equivalent to supplying electricity to about 25,000 small homes.

14. In addition to lighting at night, by day BENLESA provides electricity for Monterrey's Metro, Monterrey's water and drainage system, the general offices of the state government, and DIF (System for Integral Family Development) of Nuevo Leon. Padilla noted that the Metro will be run 100% by methane gas produced by the SIMEPRODE plants, making it the only metro in the world to use entirely clean energy. With the increase in generation capacity, energy will also be provided for tourist areas in Monterrey, such as the new Paseo Santa Lucia riverwalk, as well as adding other municipalities in the metropolitan area.

15. The technology for the project is based on a European model, but some adaptations had to be made for the Nuevo Leon plant due to the hotter climate. This tropicalization is the reason why it took four years for the plant to begin operating. The first phase of the project cost US\$11 million, but this was due to the initial trial and error period, according to Padilla. An additional US\$6.5 million was needed to expand the project. Nuevo Leon did not invest any money in the project, only BENLESA did. Nonetheless, Padilla noted that the project is "financing itself." The energy produced is much cheaper since it does not use fossil fuels, gas or petroleum. The savings for its customers in energy costs is about 12%. More importantly, the energy generated is clean energy, and solves the problem of greenhouse gases generated by the methane gas produced by the

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landfill waste. This methane destruction will allow SIMEPRODE to seek carbon funds through the Kyoto Protocol, which Padilla noted it has already begun to do.

Wind Power: A lot of Valuable Hot Air?

16. Another public-private initiative being pursued by the Nuevo Leon government is a wind energy project in the municipality of Santa Catarina, adjacent to Monterrey. The Eolica Santa Catarina project will be run by Econergy, an international renewable energy producer focused primarily in the Americas. It has invested US\$50 million in the Santa Catarina project. Eight turbines have already been bought and will arrive in September. The turbines, purchased from the German company DeWind, will each have the capacity to produce 2.5 MW of electricity for a total generation capacity of 20 MW. The energy will be used to light up Monterrey's avenues and serve other neighboring municipalities. The project is expected to begin operating in 2009. According to Nuevo Leon Energy Coordinator Alejandro Lambreton, the savings for the municipalities could be 20-25%, and more turbines may be purchased in the future.

17. Monterrey TEC is also exploring the use of wind energy to better meet Mexico's needs. It's Center for Energy Studies has designed an aerogenerator for places where the electricity of the CFE does not reach. A prototype is being tested at a ranch in General Teran, Nuevo Leon. In addition to using wind energy, solar rays are captured by photovoltaic panels installed in the roofs of four rooms which also house the regulators, converters, and batteries used to control, convert, and store energy from both sources. In this way, on cloudy days the electricity that is not generated by solar power can be obtained through wind.

The owner of the ranch invested about US\$6,000 in the equipment and construction of the four rooms, but he expects to earn it back within five years through the savings of what he would have had to pay if he were connected to the CFE. Another ranch owner in Villaldama, Nuevo Leon has also purchased an aero generator from the TEC and is using it, along with 8 solar panels, to power a refrigerator, 10 lamps, and two TVs. In addition, the Center for Energy Studies has another prototype it is testing at Monterrey TEC's campus. In 60 days, three wind generators and solar panels have contributed 20 KW/hour to the campus' local network.

18. Wind energy is a promising market for Mexico, according to Craig Houston of Garrad Hassan. Garrad Hassan is a UK company present in 17 countries that primarily provides consulting services on wind energy. They have an office in the municipality of San Pedro just outside of Monterrey that serves all of Mexico. The office has so far assessed about 450 companies interested in developing wind projects in Mexico, among which are Cemex, Gamesa, Pinales, BBVA and the World Bank. According to Houston, Mexico is one of the strongest in terms of potential in the wind energy market because it has among the most hours of wind in the world. Houston predicts that 2-3 gigawatts of wind energy will be produced in Mexico by 2014, but the country has the potential to produce ten. Other sources estimate that Mexico could generate 10% of its electricity through wind power, which would displace the estimated 40% of future natural gas imports.

19. Within Mexico, Oaxaca has the greatest potential for wind power. It has an annual wind mean speed of 10 meters/sec, which Houston noted is among the best in the world. He further noted that 7m/sec is considered profitable. There are currently about ten experienced international companies with wind energy projects in Oaxaca. The CFE is also developing a project there. Aside from the Eolica Santa Catarina project in Nuevo Leon, Lambreton mentioned the possibility of another wind energy project in the northern part of the state, specifically in the municipality of Cerralvo. Cerralvo is considered to be the best place for wind in Nuevo Leon with a 52.5 MW capacity. Interestingly, Houston pointed out that Nuevo Leon is not considered to be a good area for wind energy, although it merits further study.

Water, Jatropha, and Algae; But Hold the Ethanol

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10. Another developing project that could set Monterrey apart in the world of alternative energy is the invention of a new hydraulic machine by Monterrey native Fernando Gracia. Gracia is an entrepreneur who realized that existing hydraulic power technology would be impossible to use in Mexico due to the high purchase and maintenance costs. He therefore set out to invent something better. The result was a new mechanism which employs a buoy that produces a pressure differential within a hydraulic circuit. The circuit causes a turbine to spin and is connected to an electric generator which produces the energy. The mechanism has already been patented in 48 countries and construction of a prototype is underway. Gracia has assured that his new technology will be produced entirely in Monterrey for the benefit of all Mexicans. He has also pointed out that whereas wind energy takes US\$2 million to produce 1 MW of energy, his hydraulic power technology will cost US\$1.4 million to produce the same.

¶11. Jatropha is another energy source drawing investors attention to Mexico. Jatropha is a plant that produces beans that aren't edible to humans. As a result, its oil, used to produce biodiesel, costs less and doesn't have to compete with markets for human and animal consumption like corn and soybeans.

Moreover, the seeds from a jatropha plant have the capacity to produce four times more oil than corn and ten times more than soybeans. Jatropha is abundant in Mexico and may have originated in Mexico and Central America. Some other advantages are that it can grow in poor soils and doesn't need a lot of rain. Once planted it can grow for 40 years without having to go back and plant year after year. According to Nuevo Leon's Agrarian Office, there are currently 25 companies interested in investing in farms within the state to produce jatropha. Among these is Grupo Santos, which is working in coordination with Monterrey TEC. Monterrey TEC has been studying the biodiesel potential of jatropha. Its Physics Laboratory planted 1000 jatropha trees in 2006. Concurrently, TEC's Department of Environmental Systems is testing the resistance and oil generation of the trees. Thus far, their studies show that one hectare with 2,500 trees should produce 2,500 kg of oil. In the rest of Mexico, an investment of US\$300 million is expected this year from various foreign companies, including Global Clean Energy Holdings of California and Jatro Biofuels of Germany, which are planning to harvest jatropha in the states of Michoacan, Chiapas and Yucatan.

¶12. A less familiar alternative energy source being promoted by three young and aspiring Monterrey entrepreneurs is that of microalgae. Brothers Alan, Ivan and Eric Alvarez are developing a project that will use extracted lipid oils from microalgae to produce biodiesel. According to Alan Alvarez, the advantages of using microalgae to produce biodiesel is that it is a clean and abundant source of energy, and one that is not needed for human consumption unlike soya and ethanol. It can also be reproduced quickly, every 14 days compared to every 3 to 4 months for soya and ethanol. In addition, it does not require much land to produce, and the cost of the infrastructure needed and for transportation is low. The Alvarez brothers pointed out that the process of converting microalgae into fuel is about 40 years old but has not been applied, so the technology is very new. They estimate that with one hectare of land, they could produce 40,000 liters of biodiesel in two weeks at a cost of about 50 cents/liter, which they claim would include all costs, even patents and lab construction. They noted that the cost of other biodiesel being produced in Mexico costs approximately 75 to 95 cents/liter. The project plan they have developed would be run by Neumatic Technologies, an electronics company founded by Eric Alvarez. A site where the laboratory would be built has yet to be determined, although it would have to be a coastal location with a relatively stable climate. A prototype verifying the estimated oil production and invested costs has also not been produced yet. The Alvarez brothers are in the process of securing funding for a start-up. They are aiming for federal funds most likely through SAGARPA (Mexico's agricultural secretariat) or CONACYT (Mexico's science and technology agency). According to the Alvarez brothers, no such project exists thus far except for something similar in Australia, and a project just started in Argentina this year. If they succeed, the project may well introduce a whole new alternative source of energy not only for Mexico, but one that could be applied elsewhere.

¶13. Ethanol as an alternative energy source is one that is

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proving controversial for Mexico, due to concerns that the corn or sugar used will be diverted from human consumption. Last year a study was commissioned by the Energy Secretariat to look at the potential and viability of the use of ethanol and biodiesel for Mexico. The study revealed that for an ethanol program to be successful the costs of production would need to

be reduced and productivity increased, given that the price of sugar cane per ton in Mexico is nearly US\$38, three times more than in Brazil, and for corn it is about US\$120. These cost issues have already jeopardized a proposed investment by Bioenergia Integral. In 2007, the Mexican company announced it would build four ethanol plants in the states of Nuevo Leon, Nayarit, Sonora and Tamaulipas, at a cost of US\$73 million. It signed an agreement with the National Water Commission to modernize a district in the municipality of Anahuac, Nuevo Leon, site of one of the proposed plants, in order to guarantee the water needed to harvest 15,000 hectares. The municipality has since realized the cost of this modernization would be about US\$50 million. The project, which was set to begin in 2009, is currently at a standstill.

#### Government Incentives Still Lacking

¶14. In February of this year, Mexico's Congress passed a law for the Promotion and Development of Bioenergy. The law was apparently fast-tracked and has drawn much criticism, particularly among academics. They claim they were never consulted or allowed to participate in any debate, and that the law was passed in favor of the interests of corn and sugar growers without taking into account the negative effects of mass producing ethanol or including other alternative energy sources, such as jatropha. In addition, there is no existing entity responsible for overseeing biofuels or renewable energies. Perhaps in response, another law has since been proposed for the promotion of renewable energy sources known as LAFRE (for its Spanish initials). LAFRE, which was proposed by Mexico's green party PVEM, has been passed by the lower house of Congress and is currently being reviewed by the Senate. The law includes a "green fund" to support renewable energy projects. Currently, the federal government offers some tax deductions for such projects, but no tax credits. In Nuevo Leon, no such incentives exist. Lambreton himself admitted that renewable energy is not a competitive market in Nuevo Leon because of "too much red tape and competition from other companies." Nevertheless, he claimed that other states see Nuevo Leon as a model for energy development. He noted that the state government functions primarily as a promoter. Last year the demand for electricity in Nuevo Leon reached about 1.23 billion KWh, a 4.8% increase from the year before. Lambreton further noted that the cost of electricity in Monterrey is 30% higher than the rest of Mexico because of the way in which the city's infrastructure is built, implying that there is ample incentive for further development of renewable energy projects.

¶15. Comment: Nuevo Leon appears to be applying the same strategy to the development of alternative energies that it has applied to the development of specific clusters, such as automotive, aerospace and nanotechnology. It is relying upon the private sector and academic institutions, primarily Monterrey TEC, to provide capital and invest in R&D. Thus far, this approach has proved successful with large projects in which a public-private partnership was formed. However, Nuevo Leon could be missing out on other opportunities presented by smaller enterprises or individual entrepreneurs with promising ideas but without the capital to develop them. Although it may be too soon to tell whether any of the current or proposed alternative energy projects are profitable, the cost of not trying them or studying them further may come at a greater cost for Mexico given its current inefficient energy policies and the growing demand for more electricity. End Comment.

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